

Mathematical Analysis

- **No calculators allowed on these problems**
- **Each student is allowed to post solutions to only one problem worth one point and only one problem worth 2 points prior to 10/28.**
- **Each student may also post solutions to problems worth 3, 4, or 5 points after 10/27 and before the chapter test.**

1. Write the general form ($y = ax^2 + bx + c$) of the quadratic function that passes through the points $(-4, 6)$, $(-2, 7)$, and $(0, 6)$.
3pts

2. Write the standard form of the quadratic function that has the vertex $(-5, 1)$ and passes through the point $(-2, 3)$
2pts

3. A farmer has 210 feet of fencing and wishes to enclose a rectangular plot of land for his pet Alpacas. The land is bordered on one side by a stream. He wants his Alpacas to have free access to the water in the stream. I am not sure how well Alpacas can jump, but suppose these ones hate jumping☺. Although the farmer does not want any fence along the stream, he would like them to have the maximum possible grazing area in their enclosure. Find the dimensions of this enclosure.
4pts

i) Show the relationship between the length x and width y of the enclosure.

ii) Write the area as an expression only in x

iii) Use the equation that you found in part (ii) to find the required dimensions.

4. $f(x) = -6x^4 + 5x^2 + 7x - 10$. Use Descarte's rule of signs to complete the following table.

1pt

#of possible		
Positive zeros	Negative zeros	Imaginary zeros

5. Write the quotient in standard form.

1pt

$$\frac{3 - 2i}{1 + 4i}$$

6. Simplify $i^{100} - i^{31} + i^7$
1pt

7. 2pt $f(x) = 2x^3 - 7x^2 + 22x + 13$; $2 - 3i$ is a zero of $f(x)$. Find the remaining zeros.

5pts 8. Determine any intercepts, holes, vertical asymptotes, horizontal asymptotes, or slant asymptotes in the graph of $y = \frac{x^2 - 9}{1 - x}$. Graph it.

y-intercept _____

x-intercept(s) _____

Coordinates of hole(s) _____

Equation(s) of V.A _____

Equation(s) of H.A _____

Equation(s) of S.A _____

5pts 9. Determine any intercepts, holes, vertical asymptotes, horizontal asymptotes, or slant asymptotes in the graph of $y = \frac{2x + 4}{x^2 - 4}$. Graph it.

y-intercept _____

x-intercept(s) _____

Coordinates of hole(s) _____

Equation(s) of V.A _____

Equation(s) of H.A _____

Equation(s) of S.A _____

4pts. 10. Write a rational function satisfying the following criteria:

Vertical asymptote: $x = -5$

Slant asymptote: $y = 2x - 1$

Zero to the function: $x = 2$

Your answer should be in the form $y = \frac{a \text{ polynomial}}{a \text{ polynomial}}$

3pts. 11. Find a quadratic function $f(x) = ax^2 + bx + c$ such that the maximum value of f is 8 and the graph of f has x-intercepts 3 and 7.

2pts. 12. The difference of two numbers is 7. Find the minimum value of the product of these two numbers.

- i) Let x be the smaller number and p the product. Write p as a function of x
- ii) Use the function from part (i) to solve the problem.

2pts. 13. Find a quadratic equation having roots $\frac{1 \pm \sqrt{3}}{4}$. The coefficients of your quadratic have to be integers.

2pts. 14. One of the zeros of $f(x) = x^4 + 10x^3 + 26x^2 + 10x + 25$ is i . Find the remaining zeros.

2pts. 15. Find a polynomial function with real coefficients with zeros $-4, 4, 1 + \sqrt{3}i$

1	16.	$f(x) = 2x^5 - 5x^3 + 8x - 10$. Use Descartes's rule of signs to complete the following table. <table> <tr> <th colspan="3">#of possible</th></tr> <tr> <th>Positive zeros</th><th>Negative zeros</th><th>Imaginary zeros</th></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> </table>	#of possible			Positive zeros	Negative zeros	Imaginary zeros															
#of possible																							
Positive zeros	Negative zeros	Imaginary zeros																					
1	17.	Write the quotient in standard form. $\frac{4i}{1-4i}$																					
1	18.	Simplify $2i^{520} - i^{40} + i^9$																					
1	19.	Simplify $(2i - 3)^2 - (3 + i)^2$																					
1	20.	Find a polynomial function with real coefficients with zeros 2, -1, and 3																					
1	21.	Find the vertical asymptotes of $f(x) = \frac{2x}{x^2 - 4}$																					

1	22.	Find the horizontal asymptotes of $f(x) = \frac{-3x^2}{5x^2 - x + 1}$
1	23.	Find the holes in the graph of $f(x) = \frac{x^2 - 2x}{x^3 - 4x}$
2	24.	Find the vertical and horizontal asymptotes of $f(x) = \frac{x^2 + 5x - 6}{x^3 - 36x}$
2	25.	2 is a zero of multiplicity 2 of $f(x) = x^4 - 4x^3 + 5x^2 - 4x + 4$. Find the remaining zeros.
2	26.	What is the domain of the function $f(x) = \frac{2x - 4}{x^3 - 3x^2 - 4x}$?
2	27.	Graph $f(x) = \frac{x^2 - 1}{x - 1}$
2	28.	Find a rational function that has a hole at $x = 2$, and a vertical asymptote $x = 1$
3	29.	Graph $f(x) = \frac{3x - 6}{x + 2}$
2	30.	What is the slant asymptote of the function $f(x) = \frac{x^2 + 3x - 2}{x + 1}$?
2	31.	Find a rational function whose graph cuts the x-axis at 2, has a vertical asymptote $x = -1$, and a vertical asymptote $y = 2$.
3	32.	Given that $f(i) = 0$. Find all zeros of the function $f(x) = 2x^4 - 2x^3 + x^2 - 2x - 1$
2	33.	Find the value of k such that if $f(x) = x^3 + x^2 + kx - 4$ is divided by $x + 2$, then the remainder is zero
3	34.	<p>Find two positive real numbers x and y such that the sum of the first and two times the second is 16, and the product P of these two numbers is maximum.</p> <p>i) Show the relationship between x and y as a linear equation _____</p> <p>ii) Write the product P as an expression only in x</p> <p style="text-align: right;">$P =$ _____</p> <p style="text-align: right;">$x =$ _____, $y =$ _____</p>

--	--	--